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AFRL uses real B-2 to conduct thermal testing

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WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Recent thermal testing on a B-2 ground test air frame will save the Air Force lots of time and hundreds of thousands of dollars.

The Air Force Research Laboratory's Air Vehicles Directorate, with support from the Air Force Museum, was able to conduct thermal testing on the airframe. The museum possessed the airframe for restoration and public display.

This opportunity came at an integral time during VA's research on how high temperatures affect structures. Testing could have been completed using a generic model, but it was beneficial to have a real B-2 aft deck with structural cracking.

From conception to completion, the effort took six months. "That's an extremely short period of time to get something like this done," says Maj. Robert Mann, Chief of the B-2 Systems Program Office (SPO) Systems Branch. "An opportunity presented itself that we were able to seize and save a ton of money by using that test article. The traditional way to do this would have easily cost us a year."

B-2 aft deck structural cracking is not a safety of flight concern but requires extra maintenance time and expensive repairs. Dr. Kristina Langer and Dr. Mark Haney, VA aerospace engineers, have traced the problem to thermal buckling or structural expansion and contraction caused by extreme changes in temperature from engine exhaust. Unlike other airplanes, the B-2's engines are inside its wings. Engine exhaust travels over the aft deck subjecting it to high temperatures.

Original B-2 development models considered the effects of this engine placement, but at that time, engineers lacked experience with low observable structures and used hand calculations to evaluate the model's accuracy. Today, technology like the Major Shared Resource Center, with over 3,000 processors, is available to correctly capture the complexities of this design. Langer and Haney are applying the test results to VA's research to create more accurate B-2 models, which will be used to study potential aft deck re-designs that are more durable.

Sean Coghlan, lead engineer for the experiment, worked with museum personnel for several months preparing for the tests and coordinating testing with restoration work.

"Because this aircraft doesn't have engines in it, we had to simulate the heat on the aft deck with heat lamps." Coghlan's team used tungsten filament quartz heat lamps to heat the aft deck structure to jet engine exhaust temperatures. The testing required long hours, including weekends and overtime, to be completed before the B-2, "Spirit of Freedom" was scheduled for display at the museum.

Data from the testing is still being analyzed, but already, previously unknown effects are being discovered, which will make the new models more accurate. @